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STEPS IN A JOURNEY TOWARDS A FUZZY FUTURE

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ABSTRACT

From 2009 to early 2015 the Department of Construction at Unitec Institute of Technology has grappled with the challenges of changing technology that have impacted on both what and how it teaches. It has done this within a changing organizational environment. The lack of full understanding of the potential of the technology at the outset together with the changes of management personnel and policies have meant that change has been achieved in a messy evolving manner rather than through a planned and managed process. However it did in 2010 document a strategy articulating what it wanted to achieve. This document has helped it to guide itself through the complexity of the forces of change to have made significant developments and position itself to make further progress.

Keywords: building information modelling, on line learning, strategy.

INTRODUCTION

This is a study of the complex, messy reality of dealing with multi-faceted change in a tertiary education environment. The case presented covers the period 2009 to early 2015. It is of a Department of Construction (the Department) within an Institute of Technology dealing with developments in information technology that impacted and continue to impact, on both what and how it teaches. At the same time it was in an environment of ongoing organizational change which impacted on the structure of the organization, the management personnel and on strategies and policies. Effectively at the outset, the Department did not fully understand where it was heading with the use of the technology nor the organizational context within which it would deal with change. This is therefore not a study of how change was planned and managed, rather it is a study of how it evolved in a messy fashion.

METHODOLOGY.

The paper is presented as a descriptive case study. Fellows and Liu (2008) acknowledge the case study approach enables “a description of a situation which is sensitive to the context” (p111) and that descriptive case studies enable a certain phenomenon to be systematically recorded without directly testing a theory or hypothesis. The paper may also be characterised as adopting what Crowther and Lancaster (2009) describe as the “ex post facto research method” (p133) in that it “starts with an observed phenomenon and the sets out to deduce what factors could possibly account for the phenomenon observed” (p134). In keeping with this concept the case is presented first and then is compared with literature that influenced the authors thinking. Data for the case study was drawn from direct observation and participation as well as reference to policy statements, meeting records, memos and emails etc.

The case is written from the perspective of personnel within the Department, both authors were significant actors in the case. It is important to acknowledge that some degree of self-justification and bias is inevitable.

In 2009 the Department used the term Building Information Modelling (BIM) to describe the suite of 3D based software used to facilitate various forms of design, construction and facilities management modelling. More recently it has adopted the term Virtual Design and Construction (VDC) as being a more encompassing description. Both terms are used in this paper without semantic differentiation.

The focus of the study is on how the Department has evolved to adopt new technologies and teaching and learning methods. The organisational context within which this was achieved is described first and then the Department and its actions second.

UNITEC

Unitec is a government owned Institute of Technology (strictly a Polytechnic under the NZ Education Act 1989) located in Auckland New Zealand. It offers tertiary level programmes to domestic and international students. Slowly sinking government funding for domestic students has meant that the Institute has had to operate within tight budgetary constraints for a number of years.

Unitec gained a new chief executive in 2009 and almost immediately restructured into the current structure from a more complicated matrix structure. It is structured as a conventional tertiary education institute in which academic activities reside in three faculties which break down into academic Departments. Service units provide support activities. Within this structure the Department sits in the Faculty of Technology the Built Environment managed by an Executive Dean. There have been three changes of Dean in the period of study.

Strategic Planning

In 2010 the new Chief Executive led a formal strategic planning process. As part of that process Unitec put aside its ambitions to be a university and focussed on being an effective Institute of Technology. The new strategic plan provided four strategic directions within which Faculties and Departments were required to formulate their own strategic plans. These were:

- Meeting the needs of community
- Enhancing the student experience
- Innovation in teaching and learning
- Being an excellent business (Unitec 2010 p2).

Teaching and Learning Policies at Unitec

As the Institute developed and rolled out its new strategy it developed a number of Teaching and Learning policies these included:

- The Living Curriculum 2009: This advocated a more agile approach to curriculum, greater interaction with industry and a focus on social constructivist approaches to learning.
- E-learning strategy 2010: Which promoted greater use of e-learning approaches, a change to Moodle (from Blackboard) as the Institutes e-learning platform and a number of support mechanisms to support staff learning the use of e-learning tools.
- Teaching and Learning policy 2014: This new policy requires programmes to be delivered through one of three basic models, primarily on campus, highly blended (a mix of on campus and online delivery) or authentic work based.

THE DEPARTMENT OF CONSTRUCTION

The Department of Construction offers Diploma programmes in Architectural Technology, Construction Management and Quantity Surveying and an undergraduate degree with majors in Construction Management, Construction Economics and Property Development. It is managed by a steering group (CSG) comprising the Head of Department (HoD) and senior members of staff. It has had five changes of HoD during the period of study, three of which were in an acting capacity.

Its journey of development and adaption to new technologies and teaching and learning approaches within a changing organisational environment is described below in approximate chronological order. The technological changes cover both the development of BIM in the construction industry and the evolution of e-learning support tools in the education sector.

Getting to Understand BIM

For a number of years prior to 2009 the Department had been teaching 3D drafting using Autodesk Revit on its Architectural Diploma. However the potential for the use of BIM in construction management and quantity surveying had not been explored and was not understood by staff teaching in that area. In early 2009 awareness of the potential of BIM as a significant change agent for construction grew within the Department. It was decided to run a project to explore the potential of BIM and Department funds were able to be made available for the project.

The BIM project was established in June 2009 and ran until the end of the year. It engaged graduates from the Architectural Technology Diploma to build models and senior students from the degree programme to run exercises on the models. In the construction management area (4D) exercises to animate the construction sequence and to use clash detection tools were run. With regard to cost modelling (5D) Exactal provided the 3D capable version of their CostX programme and provided training and support. The students demonstrated that quantities could be produced from the models that had been created and estimates produced.

This work combined with research of industries practices was published (Boon & Prigg 2011 & 2102; Boon, Prigg and Mohammad 2011).

The project was wound down towards the end of 2009 with the understanding that in order to make substantive progress in the roll out of 4D and 5D dimensions of BIM into the undergraduate programme it would be necessary to appoint a staff member to lead the process and support them with a technician capable of producing and altering BIM models. At the same time there was an evolving realisation by staff that BIM technologies had significant potential as a teaching tool.

Development of Strategy in the Department

In response to the requirements of the Institutes 2010 Strategy, the Department developed a strategic plan that reflected its understanding of the changing needs of its student, its understanding of the potential of e-learning technologies and the work it had done on BIM the prior year. Within the context of this paper the key issues were defined as:

- The adoption of BIM technologies,
- Innovation in teaching and learning (discussed below)
- The introduction of a new degree in Architectural Technology focussed on the use of BIM.

The strategy was revisited in 2011 using a process to reinforce staff buy in. Vision and values statements added. In its revised form it has provided an effective focal point for the Department as it has steered its way through the complexities of a changing environment.

With regard to innovation in teaching and learning the strategy had the aims of:

- A focus on the needs of visual and active learners (rather than aural learners)
- Embracing the use of 3D visualization and digital media as a means of allowing students to learn by exploring rather than being told
- Development of the use of online delivery to facilitate increased flexibility for the student in terms of the style, pace and location of their learning. (Department of Construction Strategy 2010).

Development of E-learning Capabilities

The initial roll out of the Departments Teaching and Learning Strategy was supported by a series of staff workshops in the second half of 2010. Some of these were focused on the move from Blackboard to Moodle as the Institutes mandated e-learning platform. This transition was carried out successfully but the change of platform did not in itself improve the online content of courses.

Further workshops were focused on developing understanding of the possibilities that emerging digital technologies offered. Staff were encouraged to experiment and some did so. They developed learning tools such as instructional videos and 3D animations. The use of online quizzes and tests also evolved at that time.

For a period after this roll out the development of teaching and learning within the Department lost its emphasis, partly due to the issue of appointing a permanent HoD remaining unresolved.

VDC in Teaching and Learning

As part of the roll out of the Department's 2010 Strategy it was resolved to implement the findings of the 2009 project and appoint an additional member of academic staff to lead the area and a technician capable of building the models to be used in teaching. An academic staff member was recruited (from within the Department's existing staff budget) and started in early 2011 but the necessary additional budget was not provided to recruit a technician. The academic staff member was therefore largely ineffective and subsequently left.

In 2012 it was decided to re-emphasise the development of VDC within the Department by forming a VDC Centre led by a senior member of staff and comprising staff with an interest in the subject. Only minor allocations of time were made for staff to work in this group, however it has defined its own terms of reference and is working with a strong sense of purpose. Some progress was made in the experimentation of the use of VDC in the teaching of both technology and construction management (McGarrigle 2014). The group's work was strengthened in 2013 when technicians were engaged on a part time contract basis to support the work of the group. This group has now been formally recognised by the Institute and at the start of 2015 has been relocated into its own space with some additional resources

VDC in Programme Content

5D modelling was introduced into the final year of the Bachelor of Construction, Construction Economics major in 2010. This was done with the support of the

software supplier and specialists from industry teaching the use of the software. Teaching was done using the model developed in the 2009 project.

Limited progress has been made in the construction management area. In 2014 for the first time students were required to link activity schedules developed in MS Project to a 3D model. Some external funding has been obtained to assist this development.

An elective course “Advanced BIM in Construction” has been introduced into the degree programme. It will be run for the first time in 2015. It is intended to use this course to pilot expanding course content regarding BIM.

The availability of BIM models for use in teaching has been a severe constraint on the development of the use of BIM in teaching. The establishment of the VDC unit described above is intended to fix this problem.

Steps Towards Mobility and Flexibility

The statements in the Department’s 2010 Strategy regarding increased flexibility for the student in terms of the style, pace and location of their learning reflected a growing awareness of changing needs of students. Particularly that more students were opting to work and study at the same time.

For a number of years the Bachelor of Construction had been delivered to facilitate a preferred mode of study whereby students do the first two years fulltime and the final year over two part time years whilst working in industry. Courses on the final year are delivered by the students attending a two day block at the start of the semester and a second two day block mid semester. The remainder of the learning takes place through self-directed study centred on major assignments and a final examination. The model has allowed the students to move away from Auckland as they pursue their careers. It is not uncommon for students to fly in from Christchurch and Australia for the block courses. In 2012 some staff began to debate whether a version of this model could also be applied to the first two years of the programme.

The Bachelor of Construction was scheduled for a review and updating in 2013. As part of the review process it was decided to consider whether a workshop format should be adopted for the first two years of the programme. The existing format for the first two years required the students to study four courses at a time by attending two, two hour lectures a week for each course over a fourteen week semester. After a consultation process it was agreed to adopt a model of two half day workshops per week. This change to the format of delivery was accompanied by a more robust induction programme, a requirement for students to bring their own computing devices and a revised assessment policy.

Development workshops were run with staff in the second half of 2013 to prepare them for the revised delivery and the changes was rolled out in 2014 with mixed success. It is planned to refine and improve the delivery in 2015.

It is worth noting that deciding on and implementing these changes was largely in the Department’s own control. It was therefore able to move quickly to achieve this change.

Acceleration of Online Learning Development

In mid 2014 when the Institute launched its new Teaching and Learning policy, the Department was encouraged to accelerate its own development. It was felt that with the change to workshop based learning and the development of the VDC center, plus the work already done on elearning, it had the platform to take another step towards

increased online delivery. The Department resolved to run pilot courses in 2015. The courses were selected by calling for staff to volunteer to change their course to some form of highly blended learning to be defined by themselves. The plan is to learn from the pilot projects in 2015 and extend the roll out in 2016 with all courses being in a mixed mode for the start of 2017.

Development of a New Degree

As described above the Department in its 2010 strategy identified that there was a place in the market for a degree in Architectural Technology with a heavy focus on BIM. Within Unitec's policies development of a new programme requires a process to be followed with staged reviews and approvals. The first stage is to gain approval to start development. Progress to gain this initial approval was a series of stutters. Each change of Dean and HoD caused approval to be put on hold while the new manager reviewed the situation and formed their own view of the direction of development. Over the period the idea morphed into a broadly based new major in Technology for the existing Bachelor of Construction with extensive VDC content. This was finally approved to commence development in in late 2014.

Current State

At the start of 2015 the Department feels that actions over the last five years are at last starting to pull together to form a coherent whole. Progress has been made in the teaching and use of VDC. Significant progress has been made in the adoption of elearning technology. The introduction of the seven week model in the degree programme has created a platform from which greater flexibility can be developed. A plan is in place to achieve delivery through a highly blended learning model by 2017. The new major in Technology is finally starting to progress.

DISCUSSION

This section represents a reflection by the authors on the experience of the case. Both authors have completed post graduate studies in management, their actions were therefore informed by the literature they read at the time of study plus subsequent readings. The literature referred to does not represent a comprehensive review of literature on the subjects, rather it is generally the literature that informed the authors thinking as participants in the case.

Strategy

Johnson, Scholes and Whittington (2008) define strategy as 'the direction and scope of an organisation over the long term, which achieves advantage in a changing environment through its configuration of resources and competences with the aim of fulfilling stakeholder expectations (p3). Porter (1987) argues that strategy should be developed at the business unit level The development by the Department of its own strategy follows this advice.

Mintzberg and Waters (1985) postulate that strategies tend to sit somewhere in a spectrum between being deliberate (they are planned in advance and then executed) and emergent (they emerge as the organisation reacts to changing circumstances). Sull (2005) describes that "Managers advancing into the fog of the future tend to either cling to the fiction of prediction despite limited visibility or veer to the other extreme, relying on good luck and hustle and hoping for the best" (p122). He goes on to argue that "To survive and thrive in volatile markets, managers can pursue a strategy of *active waiting* which consists of anticipating, preparing for, and seizing opportunities -- as they arrive" (p124).

Both the Institute and the Department had formal strategies during the period of this case. These strategies were substantially aligned with one another. However the Department never had a clear plan to implement its strategy that was agreed with and supported by senior management. This was in part due to the number of changes in Dean and HoD which resulted in considerable disjunction in the flow of actions as each new manager arrived and reviewed strategies and plans. In addition the annual budgeting processes of the Institute do not provide for longer term development. Plans therefore have to be changed from year to year according to budget allocations. It was also in part due to the Departments emerging understanding of the challenges and potential of the new technologies it was therefore always a little unclear on what it was attempting to do.

The Department's strategy can therefore be characterised as emergent in Mintzberg and Waters (1985) terms. The Department can also be characterised as deploying a strategy of "active waiting" after Sull (2005). In this case the waiting has had more to do with waiting for internal barriers to breakdown rather than waiting for market opportunities to open up.

The significance of the Departments 2011 strategy document should not be understated. Given changes in management personnel over the period it is the document that has provided for consistency in the broad development of the Department. Over the four year period since 2010 the Department has made significant progress on the strategy it articulated in 2010 and is hopefully positioned to accelerate that progress.

Innovation

In the authors thinking achieving innovation in the use of VDC and mobile technology had two main dimensions. The first to encourage staff to come up with ideas and experiment, the second to take those ideas and embed them in a more widespread manner across the Department.

With regard to encouraging staff to experiment the authors were influenced by the reports of 3M's practices that were brought to prominence in "In Search of Excellence" (Peters & Watermen 1982) and which have been updated by other authors such as Brand (1988). The idea of giving staff encouragement to experiment, together with limited amounts of time and resource was adopted and implemented. Staff response covered the spectrum of enthusiasm to indifference. The enthusiasts made considerable progress as described above.

Rolling out innovations developed by individuals across the Department has proved more difficult. The literature suggests the need for a formalised approach with stages and approvals. Trott (2012) advocates the formation of new product teams and the adoption of a structured project management process with phases and decision gates. The Department adopted this type of approach with the BIM project in 2009 and again with the introduction of the seven week model. However it has not yet done so with adopting other aspects of elearning such as the creation of instructional videos or online learning. If it wishes to meet its 2017 goals concerning highly blended learning, it may need to adopt a more formal projectised approach.

It is also worth reflecting on the differences in the Department's ability to achieve change when it could do so within its own resources and when it required permission and resourcing from the Institute. The 2009 BIM project and the change to the seven week model are instances of the former whilst the slow progress to get the architectural major to the start of development being an example of the latter.

CONCLUSION

The case study and discussion illustrates that having an agreed and articulated sense of direction even if it is not possible to have a clear plan can assist an organization to make progress in an uncertain environment. It also suggests that the advice within the management literature regarding how to manage innovation can be applied within a tertiary environment. However it can be argued that the dynamics of the relationship between the Department and senior management have been such that the Department has not acted boldly and decisively to benefit from the opportunities that changing technology has presented to it despite clearly identifying them. It could have moved faster and more effectively if it had a clear plan for the implementation of its strategy which was effectively supported and resourced.

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